

Air Source Heat Pumps HW Generation – Technical Submittal

Project: Unite, Kincardine
Project No: MC1158
TSM No: 500991-AME-ZZ-XX-TS-M-5301
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Ameon Limited Unit 9-10 Olympic Court
Boardmans Way
Whitehills Business Park
Blackpool
FY4 5GU

Tel: 01253 760160

Fax: 01253 760150

Email: enquiries@ameon.co.uk



ameon

Building Services Engineering

Project Unite, Kincardine
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Revision P01
Date 04/11/2021



Air Source Heat Pump HW Generation - Technical Submittal	
<u>ASHP/01:</u>	
Manufacturer	Mitsubishi
Model	ESA30E-25
Description	Air To Water Heat Pump Q-Ton
Location	L5 - External Plant Space
<u>ASHP/02:</u>	
Manufacturer	Mitsubishi
Model	ESA30E-25
Description	Air To Water Heat Pump Q-Ton
Location	L5 - External Plant Space
<u>CAL/01</u>	
Manufacturer	Lapesa
Model	CVM-RB-1000-PSS2
Description	Direct Hot Water Vitrified Tank
Location	L4 - Plantroom
<u>CAL/01</u>	
Manufacturer	Lapesa
Model	CVM-RB-1000-PSS2
Description	Direct Hot Water Vitrified Tank
Location	L4 - Plantroom

CO2 heat pump Q-TON series

ENVIRONMENTAL RESPECT WITH THE VERY LOW GWP REFRIGERANT

The use of R744 refrigerant gas (CO₂) guarantees a very low environmental impact. It in fact has a global warming index (GWP) of 1, and a potential for ozone layer destruction (ODP) of 0.

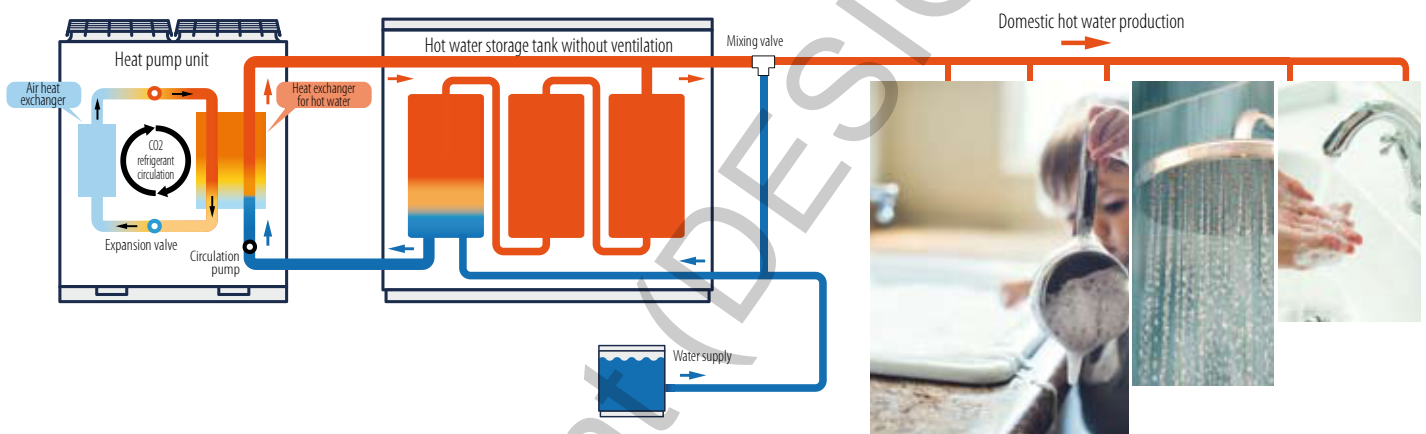
	R744 (CO ₂)	R410A	R32	R290
GWP	1	2088	675	3
ODP	0	0	0	0
Flammability (ISO817/2014)	A1	A1	A2L	A3

A1 = not flammable; A2L = slightly flammable; A3 = highly flammable

THE OPERATING CYCLE

Through the evaporator (air/gas heat exchanger), the Q-ton heat pump extracts renewable thermal energy contained in a low temperature atmosphere. Thanks to the action of the dual

stage compressor, this energy can be sold at high domestic water temperature to be heated by the gas cooler (gas/water heat exchanger).



Heat supply is stable and constant also to decrease the outside temperature.

Q-ton has a **heating capacity of 30 kW**, which it is able to maintain constant, even with an external temperature of -7° C, thus essentially guaranteeing the quantity of hot water supplied throughout the year.

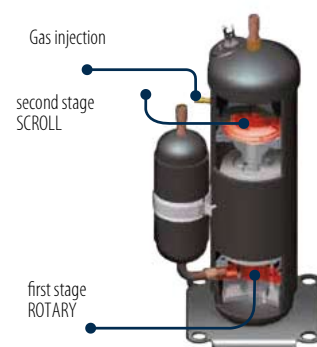
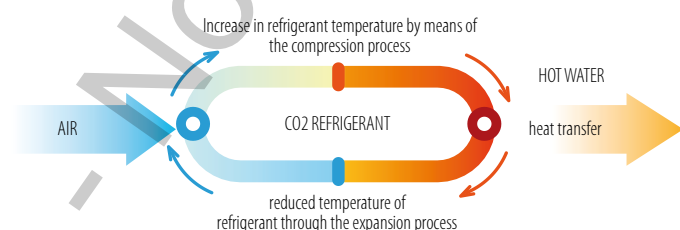
Q-ton can produce **about 750 L of hot water, post-mixed at**

45° C for each hour of operation and can also be installed in modular combination up to 16 units, allow for a reached production capacity of 480 kW (12,000 L of hot water per hour). This installation flexibility can meet the needs of small buildings as well as large spas with its easy and intuitive touch panel control system.

GSR DUAL STAGE COMPRESSOR

Q-ton uses a newly designed GSR dual stage compressor (Rotary and Scroll) for significant increases in performance at low outside temperatures. The configuration of the two stages has the advantage of offering high compression efficiency. In addition, the injection of refrigerant into the medium pressure

compartment between the two compression stages allows for greater refrigerant recirculation on the gas cooler, increasing the heating power.



CO2 heat pump **Q-TON series**

for high temperature domestic hot water production

16 units controlled by a **single** command

Up to 480 kW of capacity, connecting 16 units, each of the 30 kW . In this way it is possible to produce a quantity of hot water to meet all needs.

If all units are working in the same mode, control can take place through a single command.

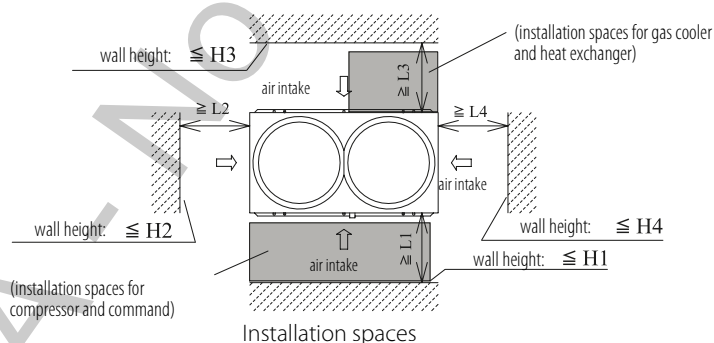


Depending on the applications and the installation needs, a 30 kW module can produce **17,000 litres of DHW per day**

Model			ESA30E-25
Power			380~410V/3Ph/50Hz
Power in intermediate seasons*	Heating capacity yield	kW	30
	Absorbed electrical power	kW	6.4
	COP	W/W	4.7
Power in winter*	Heating capacity yield	kW	30
	Absorbed electrical power	kW	7.0
	COP	W/W	4.3
DHW energy efficiency			114%
DHW energy efficiency class			A
DHW cycle size (tapping size)			XXL
Compressor	type	Dual stage Rotary/Scroll - DC Inverter	
Refrigerant	type/kg/GWP	R744(CO2)/8.5/1	
Fan	type	axial x 2	
	m ³ /h	15,600	
Circulator	type	electronic	
	-	5m @ 17 litres/min	
Sound power	dB(A)	70	
Sound pressure (1 m)	dB(A)	58	
Hydraulic connections (in/out/drain)	inches	3/4 (copper)	
	Outside air	°C	-25~+43
Operating temperature	Incoming air	°C	+5~+63
	Outgoing water	°C	+60~+90
Dimensions	HxLxD	mm	1690 x 1350 x 720
Weight	net/gross	kg	375/385

* Heating power, electricity consumption and COP measurement conditions comply with the JRA4060 directives of the Japanese Industry Association of Refrigeration and Air Conditioning, related to the performance of heat pump systems for heating water with a power of 30 kW. The data contained above refers to the following standards: EN16147:2011; EN50564:2011; (EU)No:812:2013; (EU)No:813:2014; OJ 2014/C 207/02:2014

Spaces for installation and service

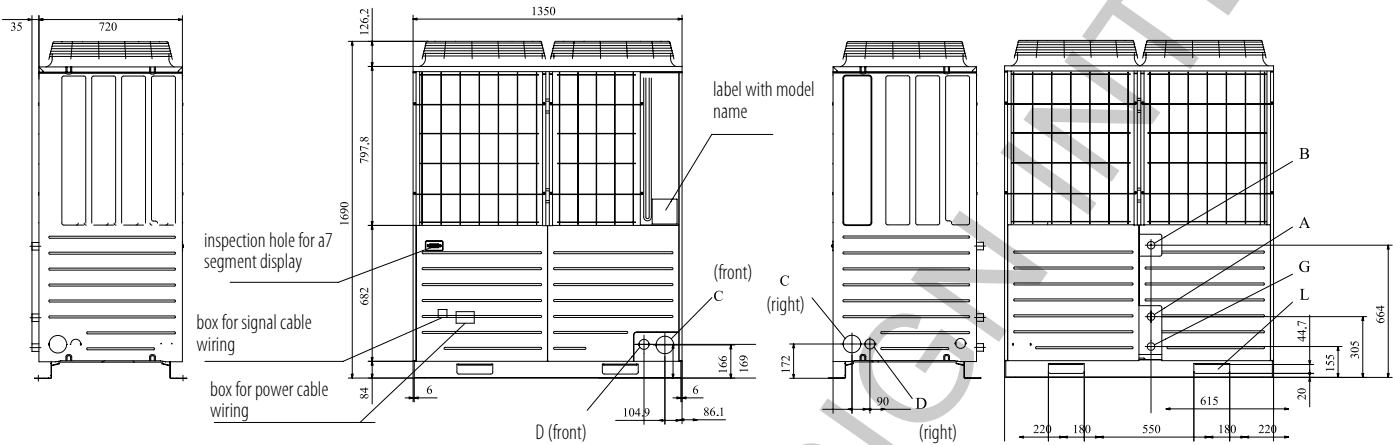


Dimensions	1	2
L1	800	800
L2	10	10
L3	800	800
L4	100	500
H1	500	1500
H2	No limit	No limit
H3	1000	1000
H4	No limit	No limit

CO2 heat pump Q-TON series

ESA30E-25

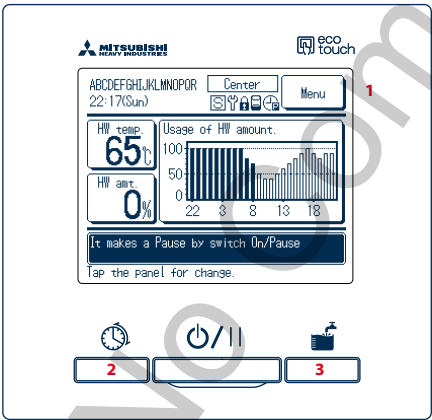
Diagrams and measurements



Item	Description	
A	Water inlet port	RC 3/4 (20A copper pipe)
B	Hot water outlet port	RC 3/4 (20A copper pipe)
C	Output lines for connection between the heat pump and the tank	Ø 88 (or Ø 100)
D	Power cable inlet	Ø 50 (right, front) bottom hole 40x80
G	Drain water piping output	RC 3/4 (20A copper pipe)
L	Opening for movement	180x44.7

LCD PANEL WITH LIQUID CRYSTAL TOUCH SCREEN FOR REMOTE CONTROL

To improve the energy saving performance on an air/water heat pump system with CO2 refrigerant for commercial and tourist applications, it is necessary to control the heat generator to harmonise the function of the thermal storage with the hot water requirements. The remote control is equipped with a peak-cut timer, a weekly timer, an accumulated hot water temperature setting function, a time chart showing the amount of water collected, and a user manual on screen. Furthermore, a single remote control can manage the unit with thermal power 30 kW and up to 16 coupled units (for a total of 480 kW).



1. EASY TO USE

LCD panel with lit buttons.
Wide 2.8-inch display.
Backlighting.

2. PROGRAMMING

Daily, weekly and annual programming can be set.

3. THE TANK

The tank can always be manually filled.

The LCD control via touch panel allows for accurate system adjustment to obtain the maximum energy savings.

2. SPECIFICATIONS

2.1 Specifications of product (1) Heat pump water heater

Item		Model	ESA30EH-25
Power source	3 Phase 380 V $\pm$ 5%, 400 V $\pm$ 5%, 415 V $\pm$ 5%, 50 / 60 Hz		
Operation to top (In intermediate)	Heating capacity (Water amount)	30.0 L/min	
	(Power consumption)	8.97 kW	
	COP	4.30	
Operation to top (In cold season)	Heating capacity (Water amount)	5.06 L/min	
	(Power consumption)	10.73 kW	
	COP	2.80	
Operating sound pressure	(In intermediate)	58 dB(A)	(Season) *
Operating sound power	(In intermediate)	70 dB(A)	(Season) *
Exterior dimension	Height	1690 mm	
	Width	350 mm	
	Depth	720 + 35 (Water pipe connection)	
Current	Max	A21	
	Starting	A5	
Unit weight	kg375 (During operation)		
Color	Stucco white (4.2 Y7.5 / 1.1 approx.)		
Compressor	Type	×Pcs Hermetic inverter compressor	×1
	Nominal output	6.4 kW	
Refrigerant	Type	R744 (CO ₂)	
	Charged amount	8.5 kg	
Refrigerant oil	Type	MA68	
	Charged volume	1200 cc	
Crankcase heater	W20		
Anti-freezing heater	for water pipe	W21×3	
	for drain pan	W40×2	
	for drain hose	W16×3	
Heat exchanger	Air side	Copper pipe straight fin type	
Heat exchanger (Gas cooler)	Water side	Gossiped pipe coil, indirect heat exchanger	
Fan	Possession quantity of water	10 kg	
	Type	Axial flow type (direct coupled motor)	×2
	Output	×Pcs W386	×2
	Air volume	m ³ /min	260
Water pump	External static pressure	Pa50	
	Type	×Output Non-self-suction spiral type inverter pump	×100 W
	Materials contacting to water	PPS	
	Actual pump head	m (kPa) 5m (49 kPa) @17 L/min	
Usage temperature	Outdoor air temperature	℃-25 to +43	
	Refrigerant inlet temperature	℃Top up 5-35, Warm up 35-63	
	Hot water outlet temperature	℃60-90	
Water pressure range	kPa		500 or lower (Keep water pressure more than 500 kPa for heat pump water heater)
Defrost	Hot gas type		
Vibration and sound proofing devices			Compressor ; placed on anti-vibration sound insulation
Protection devices			High pressure switch, over current, power transistor overheat protection, anomalous high pressure protection
Pipe connection	Feed water inlet	Rc3/4 (Copper 20A) *	4
	Hot water outlet	Rc3/4 (Copper 20A) *	4
	Drain water outlet	Rc3/4 (Copper 20A) *	4
Electric wiring	Earth leakage breaker	30A, 30mA, 0.1sec	
	Power cable size	□8mm ² × 4 (Length 70m)	
	Molded-case circuit breaker	Rated current 30A, switch capacity 30A	
	Grounding wire	size M6	
Design pressure	High pressure	14.0 MPa	
	Low pressure	8.5 MPa	
IP code	IP24		

(3) Water piping connection

The distance between heat pump water heater and hot water of energy saving. Please decide the pipe size and length head (at the maximum flow volume) of heat pump water heater.

(i) Allowable external head

Allowable external head: 5mAq (49kPa) at 17 L / min (Max)

(ii) Pressure loss of the pipe, joint and option part

① Pressure loss of pipe

Typical pressure loss is shown in following table. Please referring following table

Nominal diameter (mm)	Flow volume (L/min)	Rough indication of pipe friction resistance (kPa / m)
20A20	0.1mAq	(1 kPa) / m
25A40	0.1mAq	(1 kPa) / m
32A80	0.1mAq	(1 kPa) / m
40A120	0.15mAq	(1.5 kPa) / m
50A160	0.06mAq	(0.6 kPa) / m
65A160	0.02mAq	(0.2 kPa) / m

② Rough indication about the equivalent pipe length correction

Nominal diameter (mm)	Equivalent pipe length (m)		
	Elbow	Gate valve	Check valve (Swing)
20A0.75	0.15	1.62	1.8
25A0.9	0.18	2.03	0.0
32A1.2	0.24	2.54	6.2
40A1.5	0.30	3.15	4.7
50A2.1	0.39	4.08	0.0
65A2.4	0.48	4.61	1.5

③ Pressure loss of option part

3 - way valve, CWFV3 : 0.9mAq (9.2 kPa) at 17 L / min

Stop valve of hot water supply, CWFV5 : 0.04mAq (0.35 kPa)

(4) Determination of the number of heat pump water heaters

Heating capacity of the heat pump water heater is more than 10kW (from piping).

Heating capacity necessary $\geq \frac{\text{Max. floor heating load}}{\text{Correction coefficient}} \times \text{Number of heat pumps}$

⇒ Max. floor heating load is 45kW, outdoor temperature is 7℃

28.5kW under this condition. (water temperature ; outlet 45℃)

Correction coefficient is 0.90 at relative humidity 78%
heat pumps are necessary.

So please be careful at the time of selection of heat pump water heater.

2.8 Operation sound

Model: ESA30 series (50/60Hz)

Measurement condition: Heating operation to top up

Outdoor air temperature: 16°C DB/12°C WB

Feed water inlet temperature: 17°C

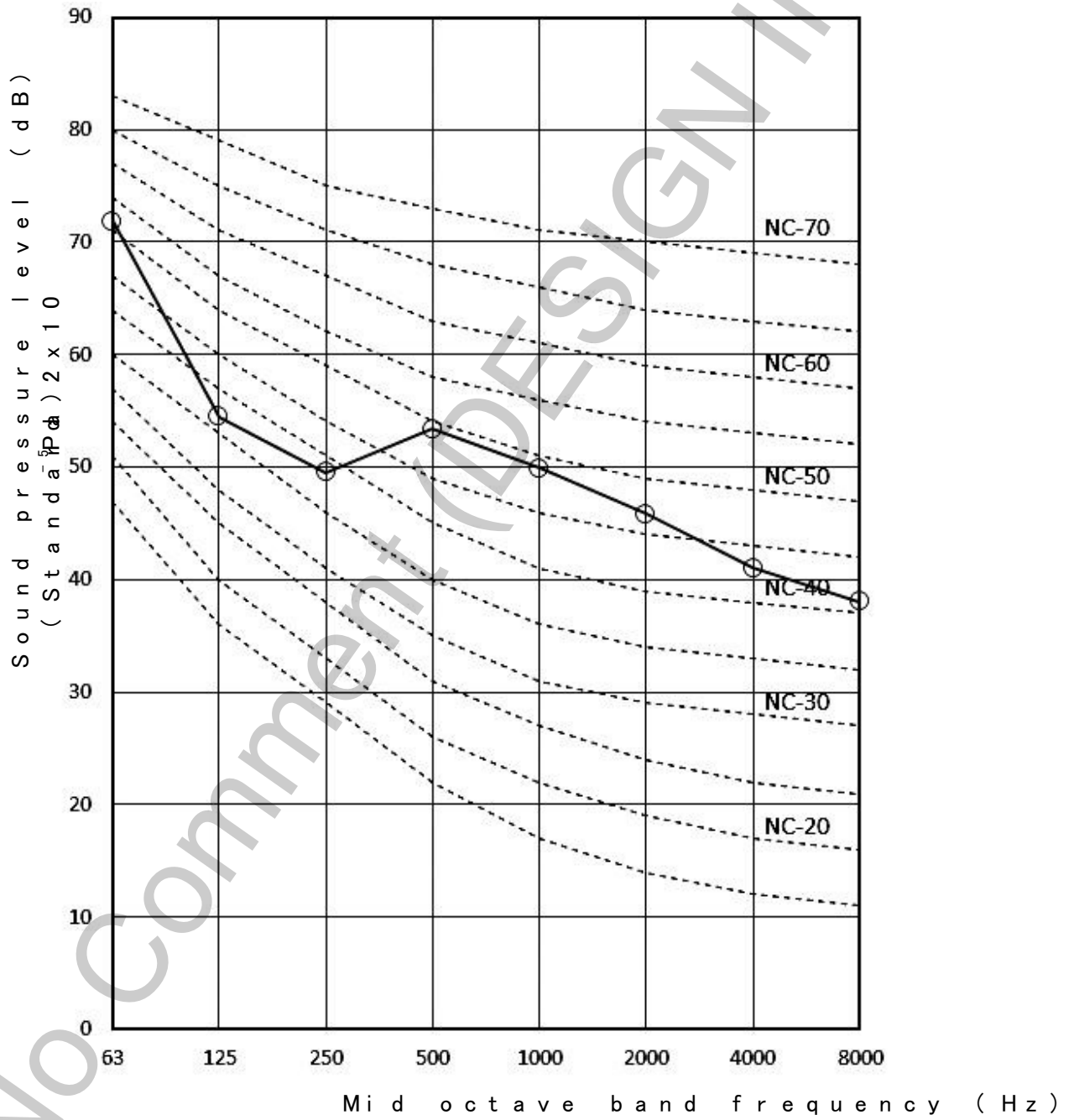
Hot water outlet temperature: 65°C (JRA 4060)

Mike position: 1m in front and 1m in height

(1) Sound power level

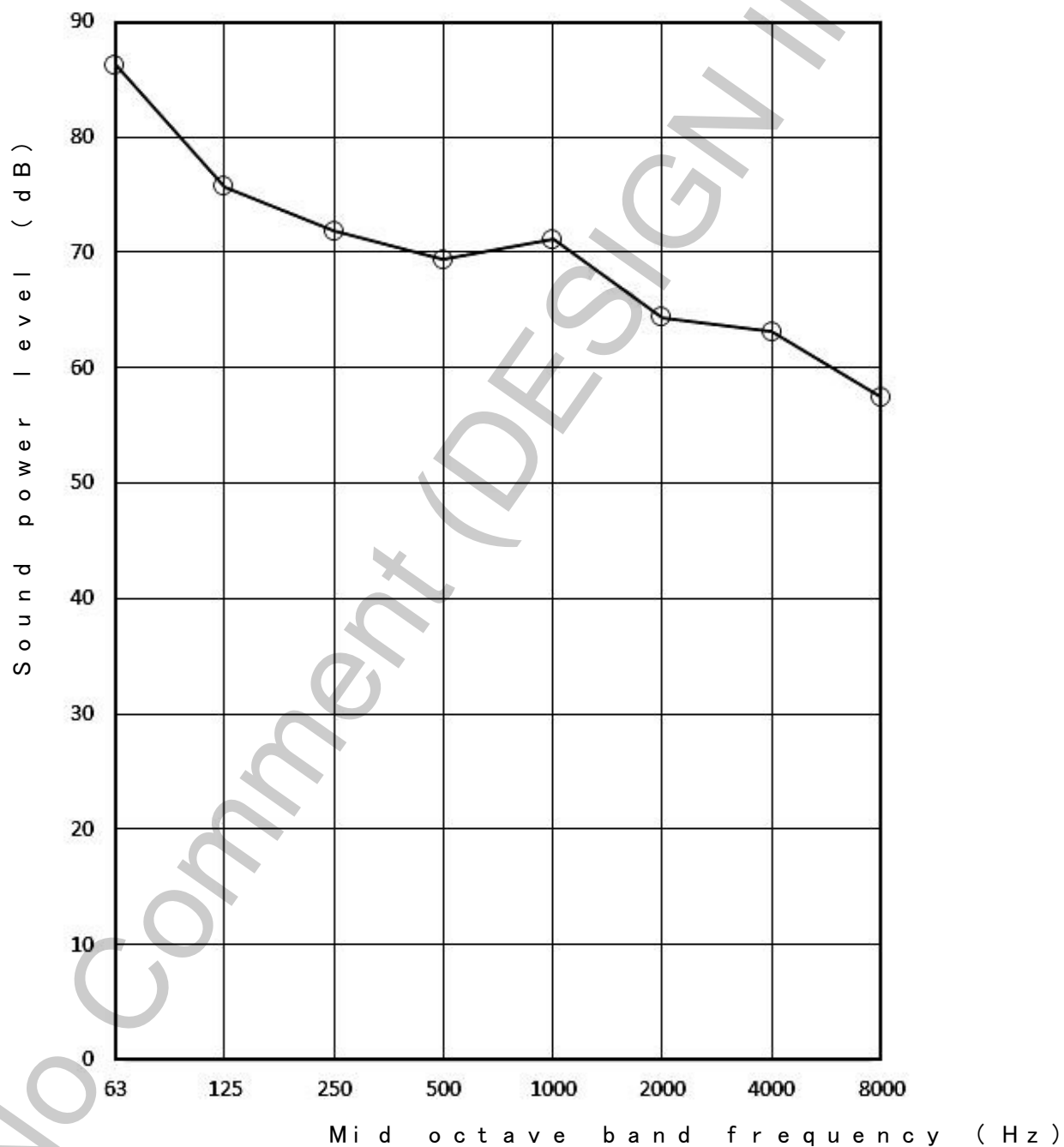


(2) Sound pressure level

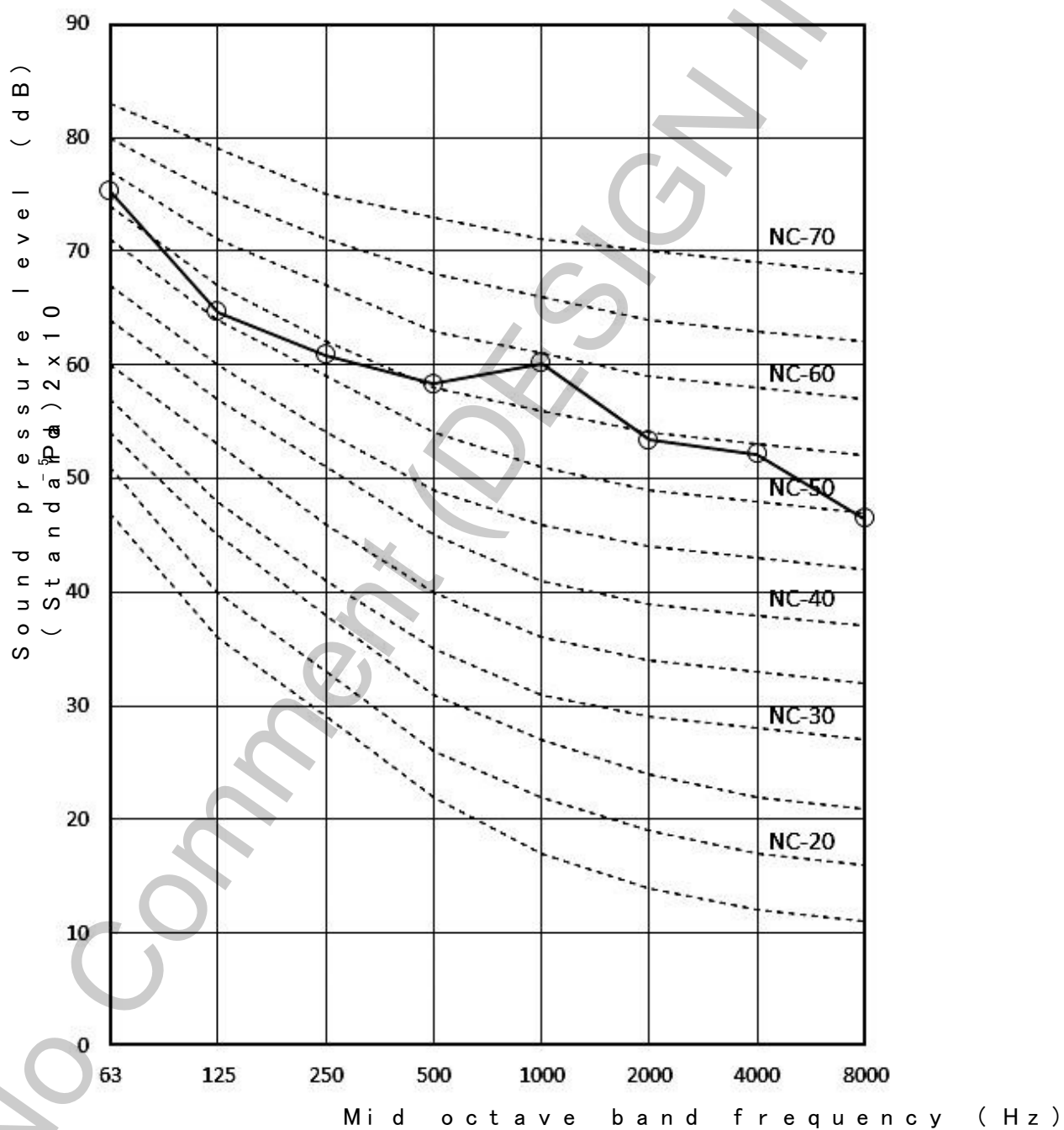


Measurement condition: Heating operation to top up
 Outdoor air temperature: 2° CDB/ 1° CWB
 Feed water inlet temperature: 5° C
 Hot water outlet temperature: 65° C (JRA 4060)
 Mike position: 1m in front and 1m in height

(1) Sound power level



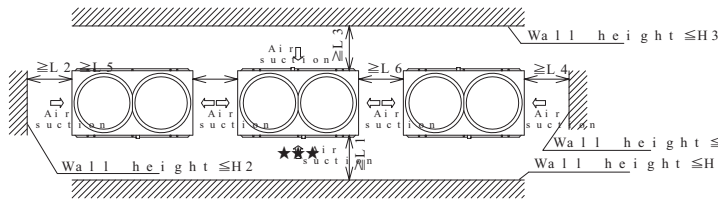
(2) Sound pressure level



2) In case that multiple heat pump units are installed

★ shows the front side of the unit

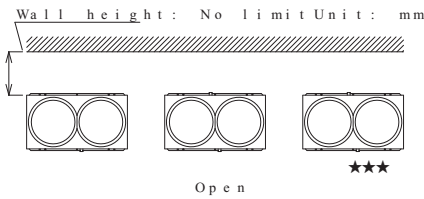
① Installation example for 3 units in a row



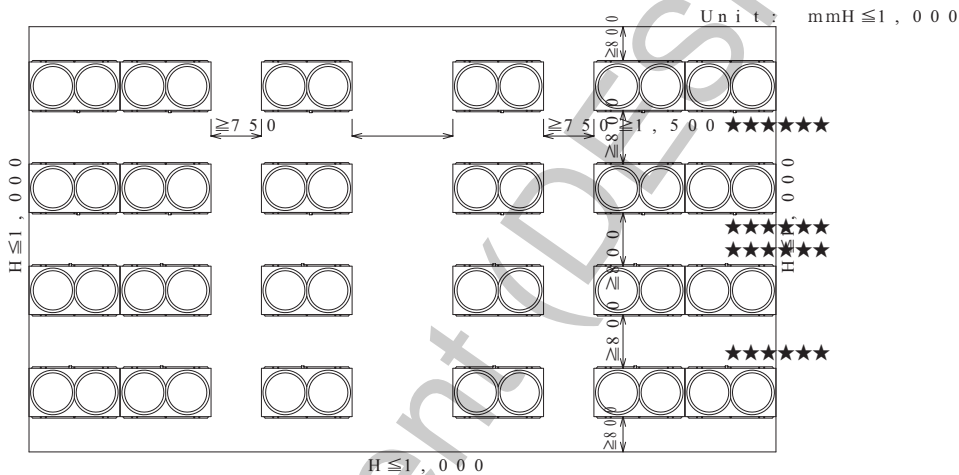
Dimension	Installation example
L1800800	
L21010	
L3800500	
L4100500	
L510*500	
L610*500	
H115001500	
H2No limit	No limit
H310001000	
H4No limit	No limit

* Units can be installed continuously

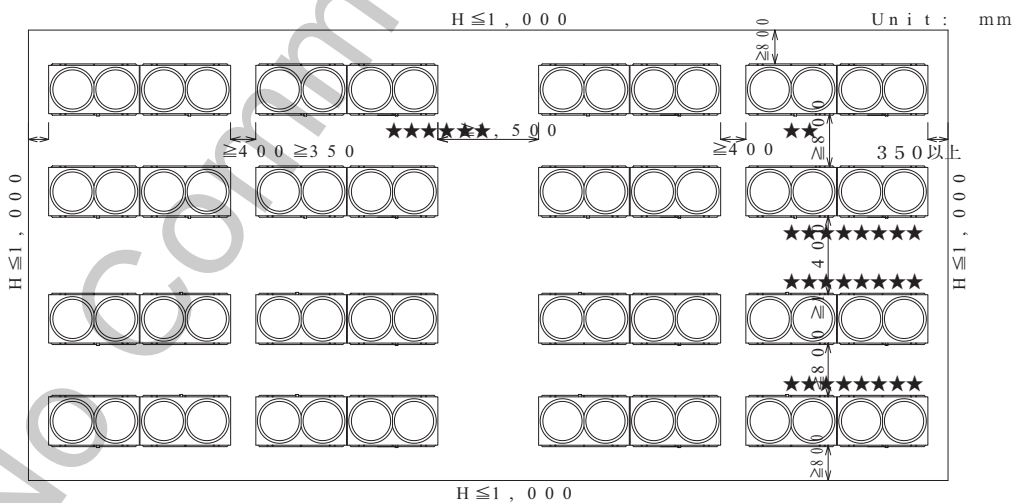
② Installation example for 3 units in a row (In case of high Please keep 10mm or more space between the units with consid



③ Installation example for 6 units horizontally and 4 units lo



④ Installation example for 8 units horizontally and 4 units lo



2-3 Unvented hot water storage cylinder Inst

According to the installation manual attached to the cylinder Please refer to the specifications of unvented cylinder procur

lapesa

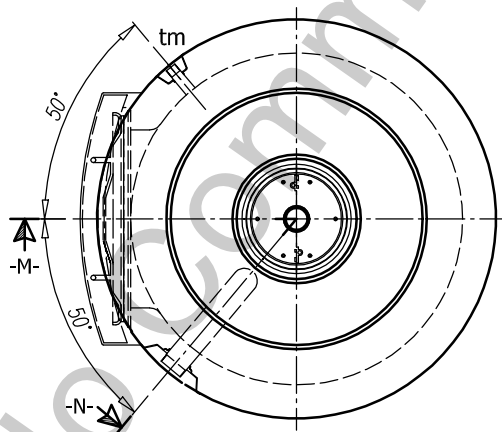
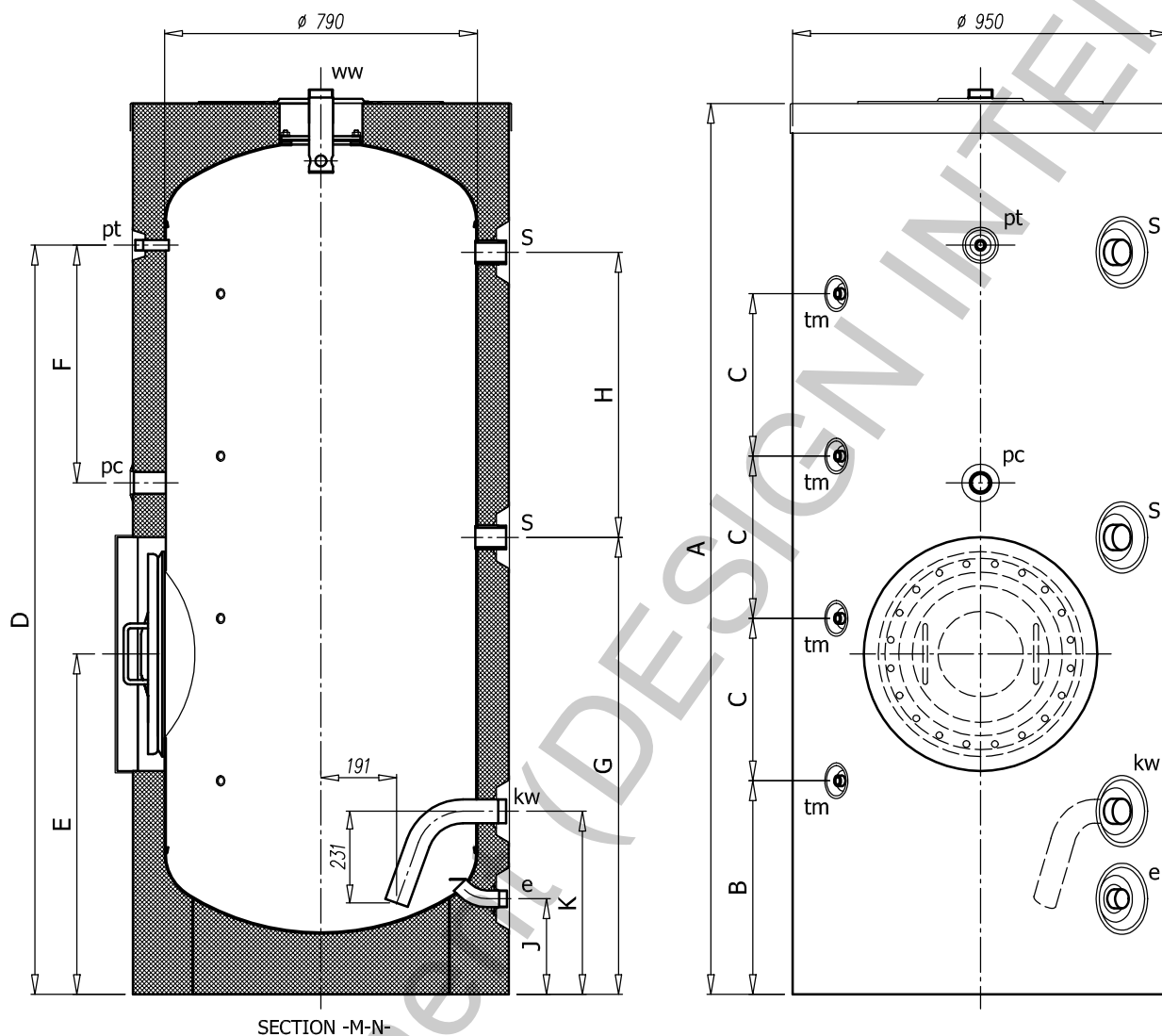
D.H.W. VITRIFIED TANK Model CVM-RB-750/1000/PSS2

Ficha Técnica

Ref.: FP20_329-01

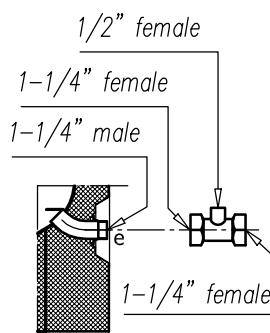
Fecha: 21/02/2019

Cliente: MITSUBISHI
HEAVY INDUSTRIES



kw	Water inlet	2"	male
e	Drain	1-1/4"	male
ww	Water outlet	2"	male
pt	Pressure and temperature	3/4"	male
tm	Water sensor	3/4"	male
pc	Cathodic protection connection	1-1/2"	female
S	Side connection	2"	male

Mod.	A	B	C	D	E	F	G	H	J	K
CVM-RB-750	1840	498	320	1550	818	300	963	570	200	420
CVM-RB-1000	2250	538	410	1890	858	600	1152	720	240	460



Drain connection detail

TECHNICALS CHARACTERISTICS

D.H.W. tank :
 * Material: S 275 JR
 Vitrified according to DIN 4753
 * Max. working pressure : 8 bar
 * Max. working temperature : 90 °C

Thermally insulated :
 * Polyurethane foam
 * C.F.C free
 * Density 45 Kg/m3
 * Thickness : 80 mm

DN 400 removable manhole
 External jackets with accesories

Conforme O.T.

Conforme Cliente

Correspondiente a

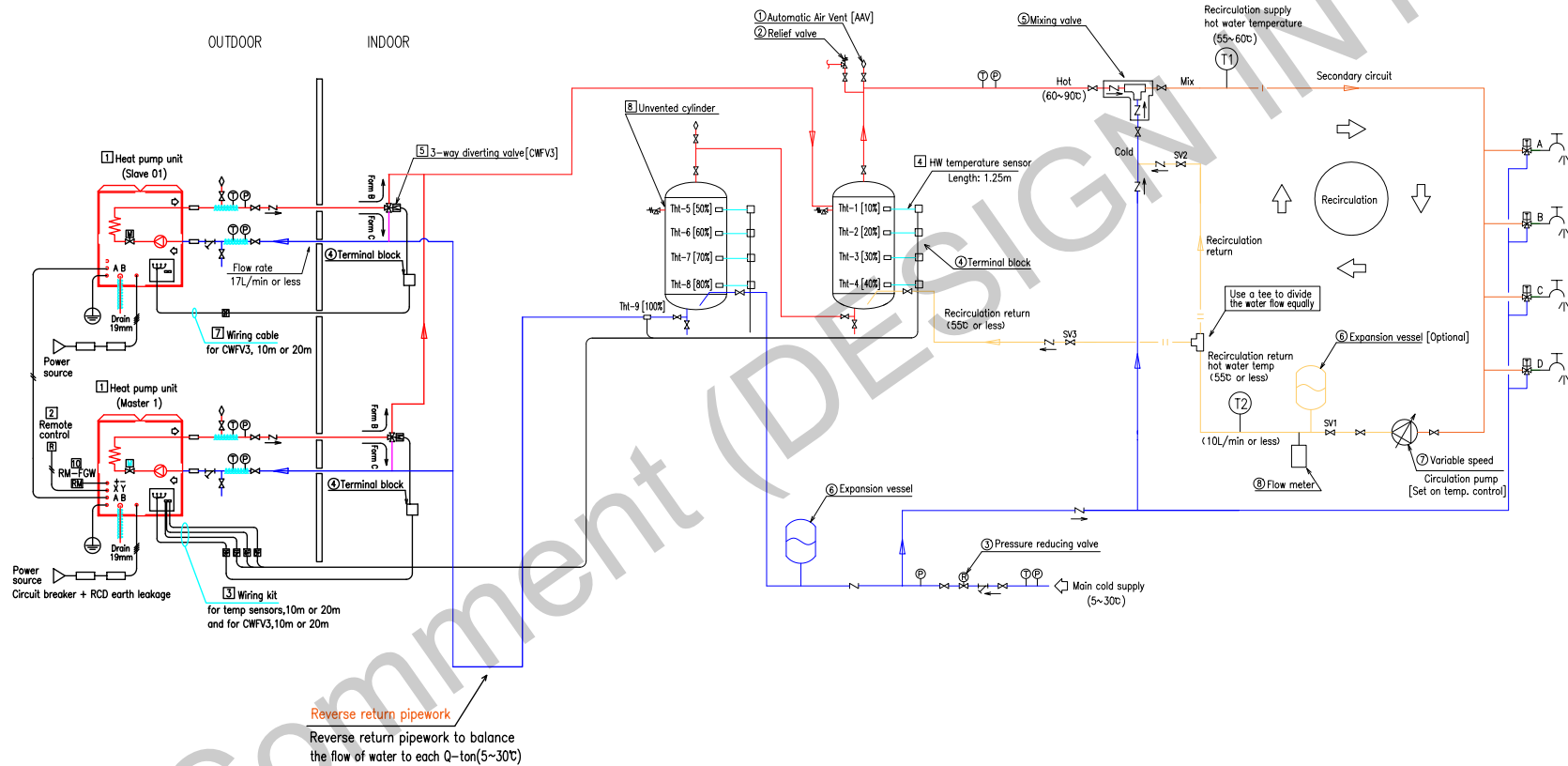
Código

* ALL DIMENSIONS AND WEIGHTS ARE SUBJECT TO NORMAL MANUFACTURING TOLERANCES *

Q-Ton Water Quality Limits

Item		Concentration / Makeup
pH (25°C)	—	7.0—8.0
Electric conductivity (25°C)	mS/m	≤30
Chloride ion	mgCl—/L	≤30
Sulphate ion	mgSO ₂₃ —/L	≤30
Acid consumption (pH4.8)	mgCaCO ₃ /L	≤50
Sulphide ion/Acid consumption	—	≤0.5
Total hardness	mgCaCO ₃ /L	≤70
Calcium hardness	mgCaCO ₃ /L	≤50
Ionic silica	mgSiO ₂ /L	≤20

1 Master + 1 Slave + 2 Tanks + recirculation



Component list(Optional parts)

No.	Part name	Model	General description
[1]	Heat pump unit	ESA30EH-25	For outdoor air temp -25°C
[2]	Remote control	RC-Q1FH	-
[3]	Wiring kit	MTH-01E or MTH-02E	20m length of wire 10m length of wire
[4]	Hot water temp sensor	MTH-03E	1.25m length of wire
[5]	3-way valve, CWFV3	MTH-04E	0.7m length of wire, AC200V, 50mA
[6]	Stop valve, CWFV5	MTH-05E	0.7m length of wire, AC200V, 50mA
[7]	Wiring cable for CWFV3 (slave unit only)	MTH-06E or MTH-07E	20m length of wire 10m length of wire
[8]	Unvented cylinder	LAPESA	-
[9]	Anti-freezing heater	FSG-10	10W/m
[10]	Remote monitoring	RM-FGW2	For remote monitoring

Component list(Locally procured)

No.	Part name	Model	General description
[1]	Automatic Air Vent [AAV]	-	-
[2]	Relief valve	-	Setting lower than 450kPa
[3]	Pressure reducing valve	-	Setting lower than 400kPa
[4]	Terminal block	-	-
[5]	Mixing valve	-	-
[6]	Expansion vessel	-	-
[7]	Circulation pump	-	Variable speed pump [Temp. control]
[8]	Flow meter	-	Measurement range 4 ~ 10L/min

SV: Globe valve (Flow volume control)
 P: Gate Valve
 C: Check valve
 F: Flexible joint
 Y: Strainer (Y-type - 60 mesh)
 M: Thermostatic mixing valve
 A: Anti-freeze trace heater tape
 T: Terminal block
 V: Automatic air vent

Note1. Q-ton's set value of temperature to tap up is max 90degC but there is the possibility of having a supply temperature higher than the set temperature.

Please select the proper material and size of pipes, components and etc. at the site.

Note2. Please refer to the Technical manual to get more installation details.

Note3. If variable speed pump is used then SV2 can be avoided.

Note4. Recirculation flow rate must not exceed 10L/min. If 10 L/min is insufficient then we recommend the use of another heating source to maintain recirculation load.

Note5. Pipe sizes are to be determined by consultant/contractor

Note6. MHIAE/MHI, BEIJER REF UK & IRELAND DO NOT HOLD DESIGN LIABILITY

REFERENCE DRAWING:

Recirculation hot water supply system
 Piping and Instrumentation Diagram
 Proposal diagram
 17.03.2021